

GEN6 ROADSHOW
PRAKTISCHE NUTZUNG VON IPv6 IM E-GOVERNMENT
Fraunhofer FOKUS, Berlin 2014

Innovative Lösungen: Robuste Feldkommunikation Katastrophen-Einsatzlagen mit IPv6

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GEN6 – Governments ENabled with IPv6

- Project time frame
 - 1.1.2012 – 31.3.2015
- 19 EU partners
 - 7 national pilots
 - 2 cross-border pilots
- EC reference
 - http://ec.europa.eu/information_society/apps/projects/factsheet/index.cfm?project_ref=297239
 - <http://www.gen6-project.eu/>



Slovenian pilot – A-ERCS

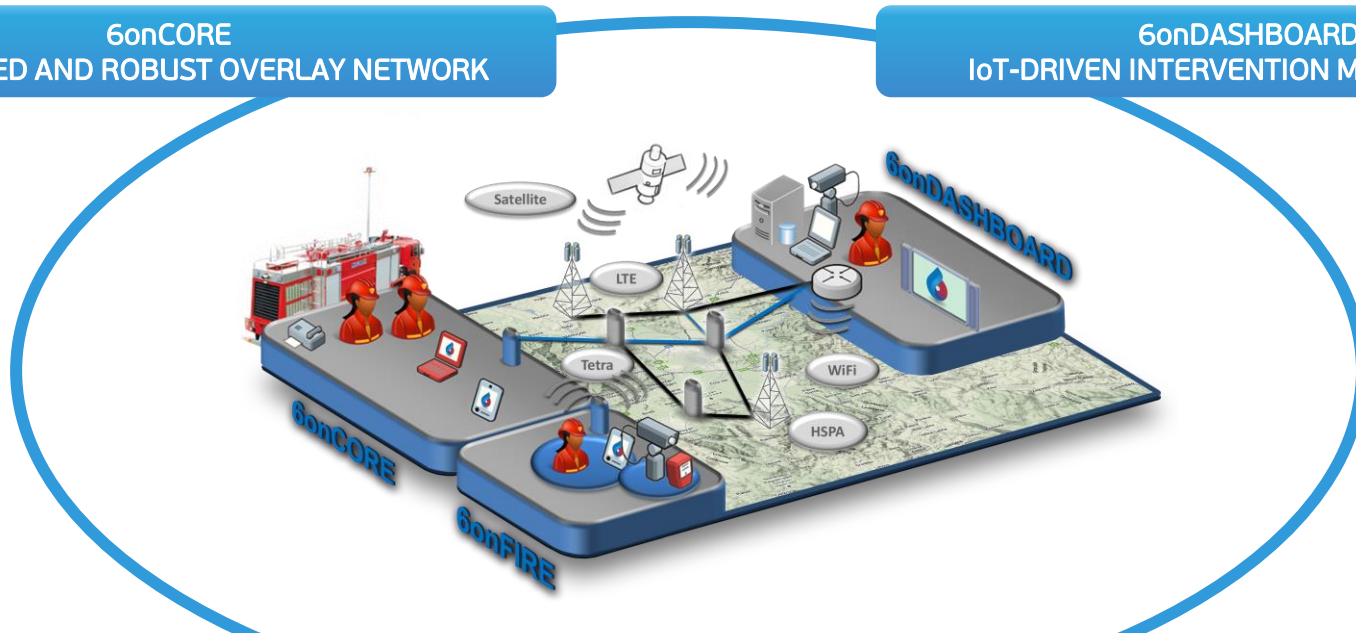
- Advanced Emergency Response Communication Solution
 - <http://www.gen6-project.eu/A-ERCS.html>
- A-ERCS System deployment name 6inACTION
 - <http://6inaction.net/>

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Smart and compact mobile solution designed to provide first responders with reliable communications and IoT-driven situation surveillance and intervention management services in emergency situations

6onCORE
DISTRIBUTED AND ROBUST OVERLAY NETWORK

6onDASHBOARD
IoT-DRIVEN INTERVENTION MANAGEMENT



6onFIRE
ON-SITE SENSOR SYSTEM

6onMOBILE
TRIAGE APPLICATION

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Every day operations

- Fire
- Flood
- Water rescue
- Car accidents
- ...



Source: Dalymail



Source: Dalymail



Source: Wikipedia

Professional and commercial communication systems are 100% operational

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Extreme natural disasters

- Earthquake in Italy (2012)
- Earthquake&Tsunami in Japan (2011)
- Hurrigan Katrina (2005)



Source: CBS



Source: A. Kwasinski



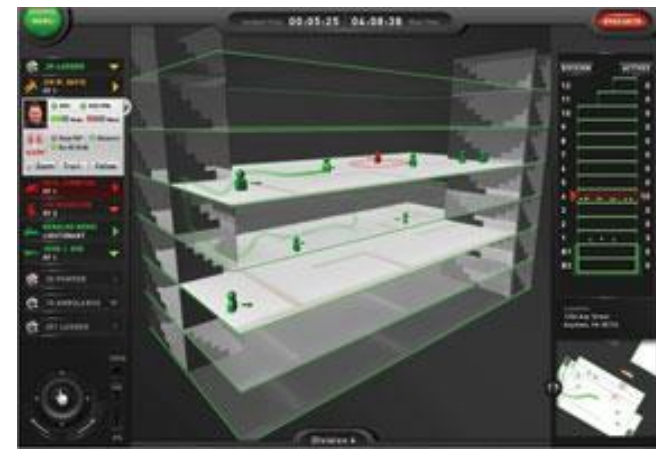
Source: Kimberly K.

Professional and commercial communication systems are down!

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Different requirements for different scenarios!

- High-performance communications in day-to-day operations
 - Integrating state of the art commercial mobile systems
- Survivable communications in extreme conditions
 - Distributed system and service intelligence
- Support for on-site intervention monitoring
 - Water level, avalanche tracking, forest heatmap, hazardous substance
- Fire responders mobility
 - Unit, user, device, sensor
- Coordinated actions across different national public safety agencies
 - Fire fighters, police, ambulance, military
- International intervention
 - On-site and cross-border cooperation
- Unit monitoring and location tracking
 - GPS location, indoor positioning, rescue squad vital signs



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6inACTION Vision

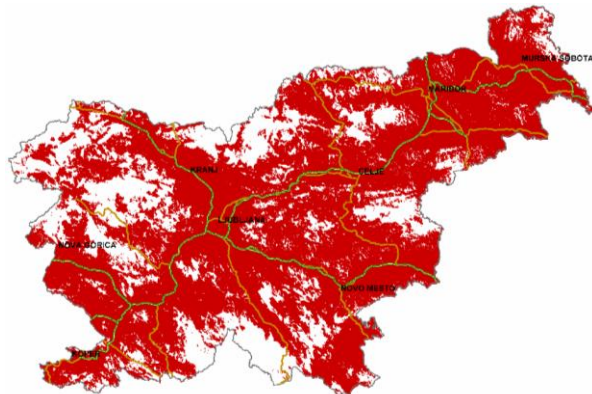
- Converged communications in emergency situations
 - a distributed and robust overlay communication solution for data transport and rich multimedia service built across professional (e.g. DMR, TETRA, Satellite) and commercial networks (e.g. UMTS/HSPA, LTE)

Satellite Communications
Coverage



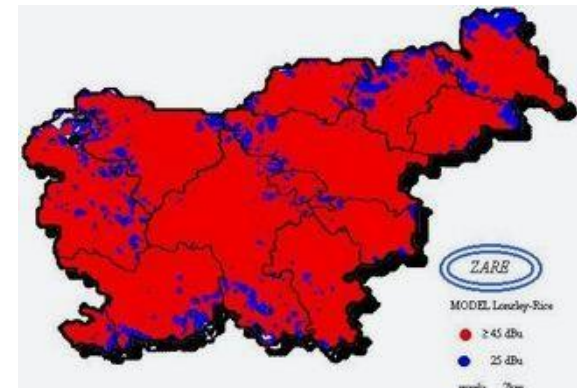
High Availability

Commercial Operator
HSPA/LTE Coverage



High Performance

Professional System
DMR/TETRA Coverage



Ruggedized Terminals

IPv6 convergence layer and smart network enabler

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6inACTION Vision – Technology

- COTS terminals and equipment



IP67, Mil, Water Proof, Crush Proof, Drop Proof, Dust Proof,

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Public Safety Regulation and Standardization

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Regulation and standardization

- **BB PPDR – BB Public Protection and Disaster Relief**
 - ITU-T - Report ITU-R M.2033
 - Radiocommunication objectives and requirements for public protection and disaster relief
 - **US FCC mandates LTE for public safety network (February 2012)**
 - **700 MHz, D Block**
 - „President Barack Obama yesterday signed into law the payroll-tax-cut extension legislation, which reallocates the 700 MHz D Block spectrum to public safety and provides \$7 billion in federal funding to help pay for the buildout of a nationwide [LTE](#) network for first responders.“
 - http://urgentcomm.com/policy_and_law/news/obama-signs-dblock-law-20120223
 - **Congressional Research Service**
 - Substantial radio coverage is targeted, and the act instructs leveraging existing infrastructure by establishing agreements to use commercial or other communications infrastructure already in place. (e.g., federal, state, tribal,)
 - **EU Regulation - CEPT ECC Report 199 (May 2013)**
 - **User requirements and spectrum needs for future European broadband PPDR systems (Wide Area Networks)**
 - **Frequency blocks**
 - 400MHz, 700 MHz, 2GHz?
 - **Defined operational environments/category for BB PPDR**
 - PP1: Day-to-day operations
 - PP2: Large emergency and/or public events
 - DR: Disaster Relief
 - **Standardization - 3GPP Release 12**
 - <http://www.3gpp.org/Public-Safety>

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First BB PPDR System by „CEPT ECC Report
199“

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SYSTEM TODAY

Backhaul

- DMR
- Telco UMTS/HSPA

On-site

- DMR radio

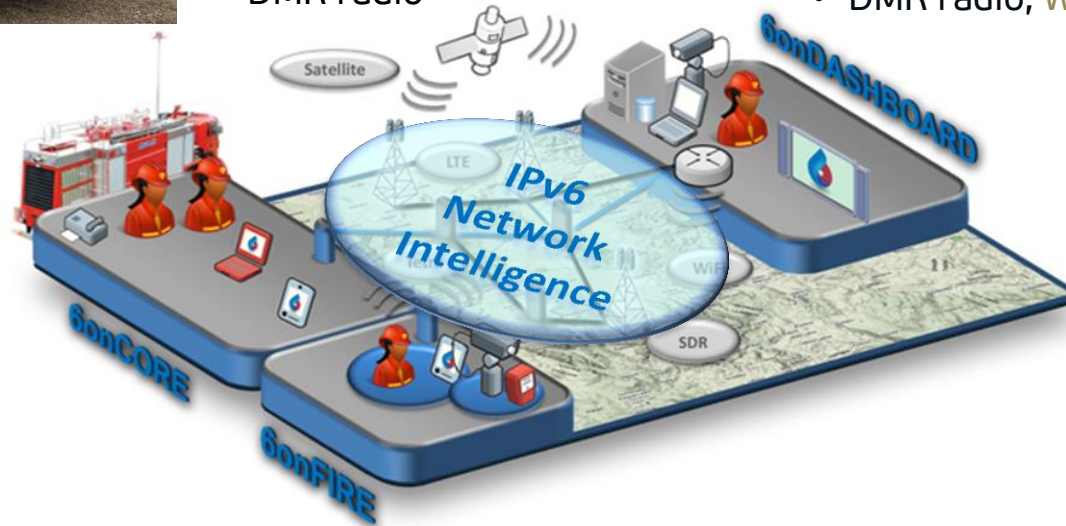
SYSTEM TOMORROW

Backhaul

- DMR, TETRA, satellite
- Telco UMTS/HSPA, LTE, WiFi
- xDSL/FTTH

On-site

- DMR radio, WiFi mesh, sensors



6onMOBILE



SERVICES TODAY

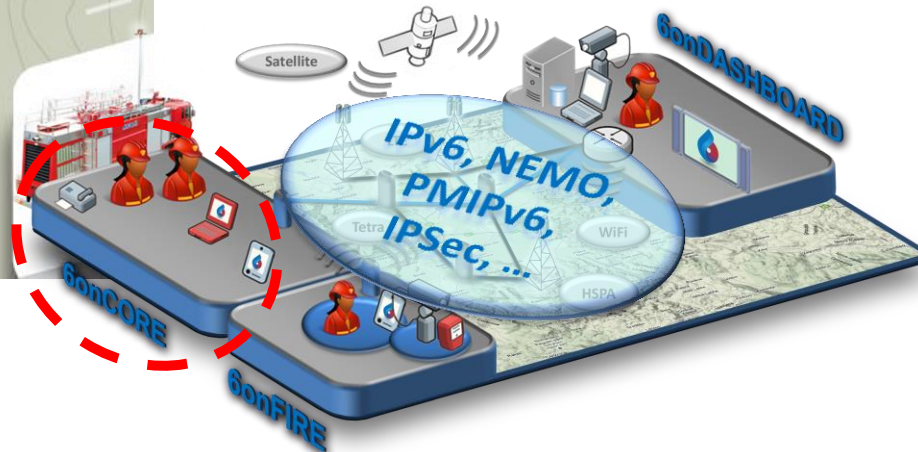
- Voice – 1. priority
- Messages – 2. priority

SERVICES TOMORROW

- Voice – 1. priority
- Messages – 2. priority
- Pictures – 3. priority
- File – 4. priority
- Video – 5. priority
- Sensor & M2M services

1 Set up on-site intervention command center using 6onCORE

- Compact mobile network node
- Installed in first responder vehicle or fully portable
- Provides communication services for intervention management by selecting best available networks for the required services
- Connects to 6onFIRE sensor deployments on site



IPv6 network intelligence

- NEMO with MCoA and IPsec
 - secure and transparent 6onCORE node mobility
- SLAAC and DHCPv6
 - host and network nodes auto configuration

Technical design

- Cisco ISR819 M2M router



- Multicast with MLD, PIM-SM and scope options support
 - flexible live multimedia streaming on-site and globally
- IPv6 hierarchical addressing
 - fast unit, user and sensor provisioning
- BGP and OSPFv3

PA addressing

- IPv6 PA and IPv4 PA addressing

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6inACTION System – High level system architecture



TACTICAL LEVEL



STRATEGIC LEVEL



USER/MISSION LEVEL

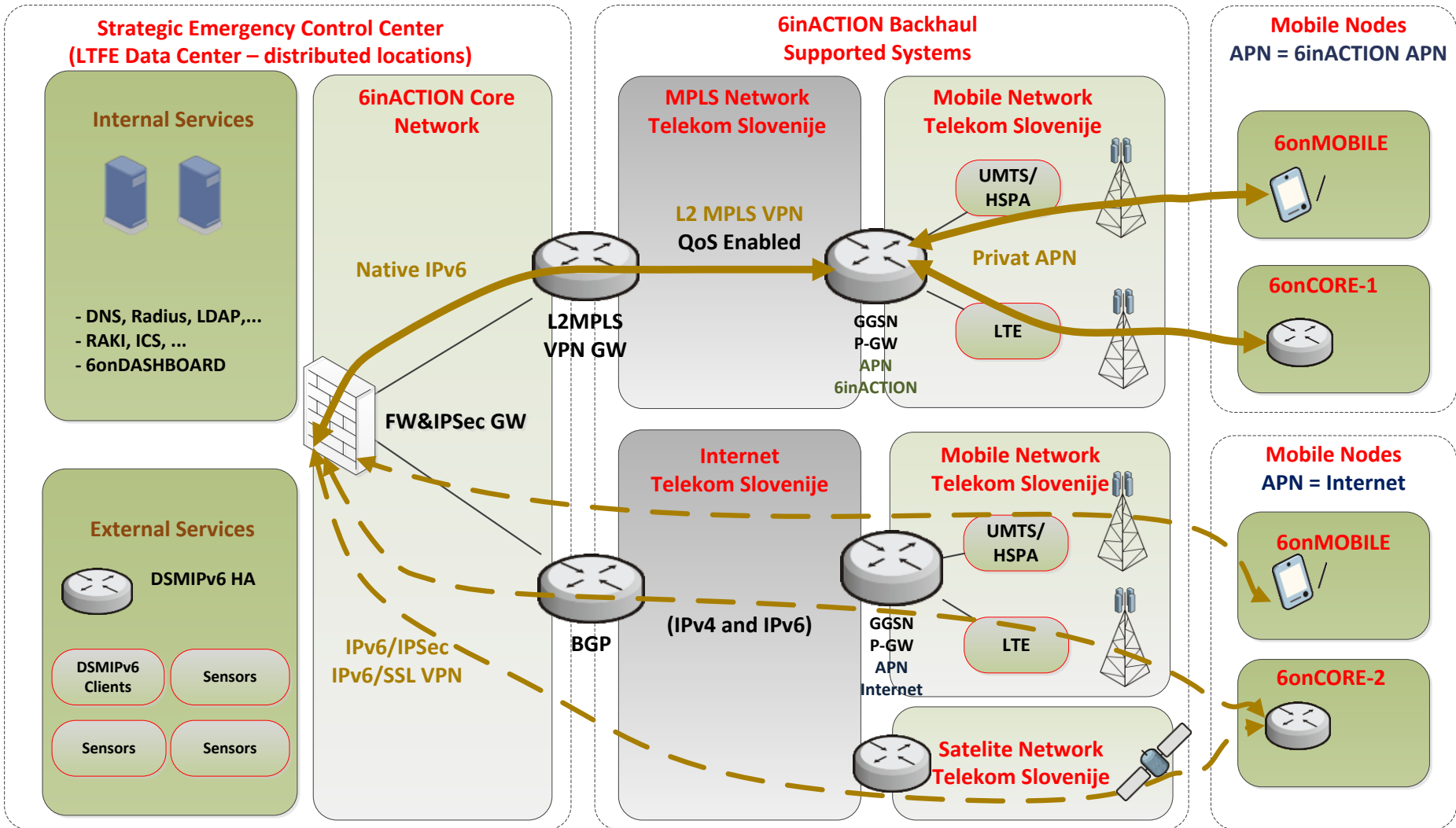


TACTICAL LEVEL



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6inACTION Deployment Architecture @ Telekom Slovenije



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Mobile node/user provisioning – private APN

- **AAA and security process**

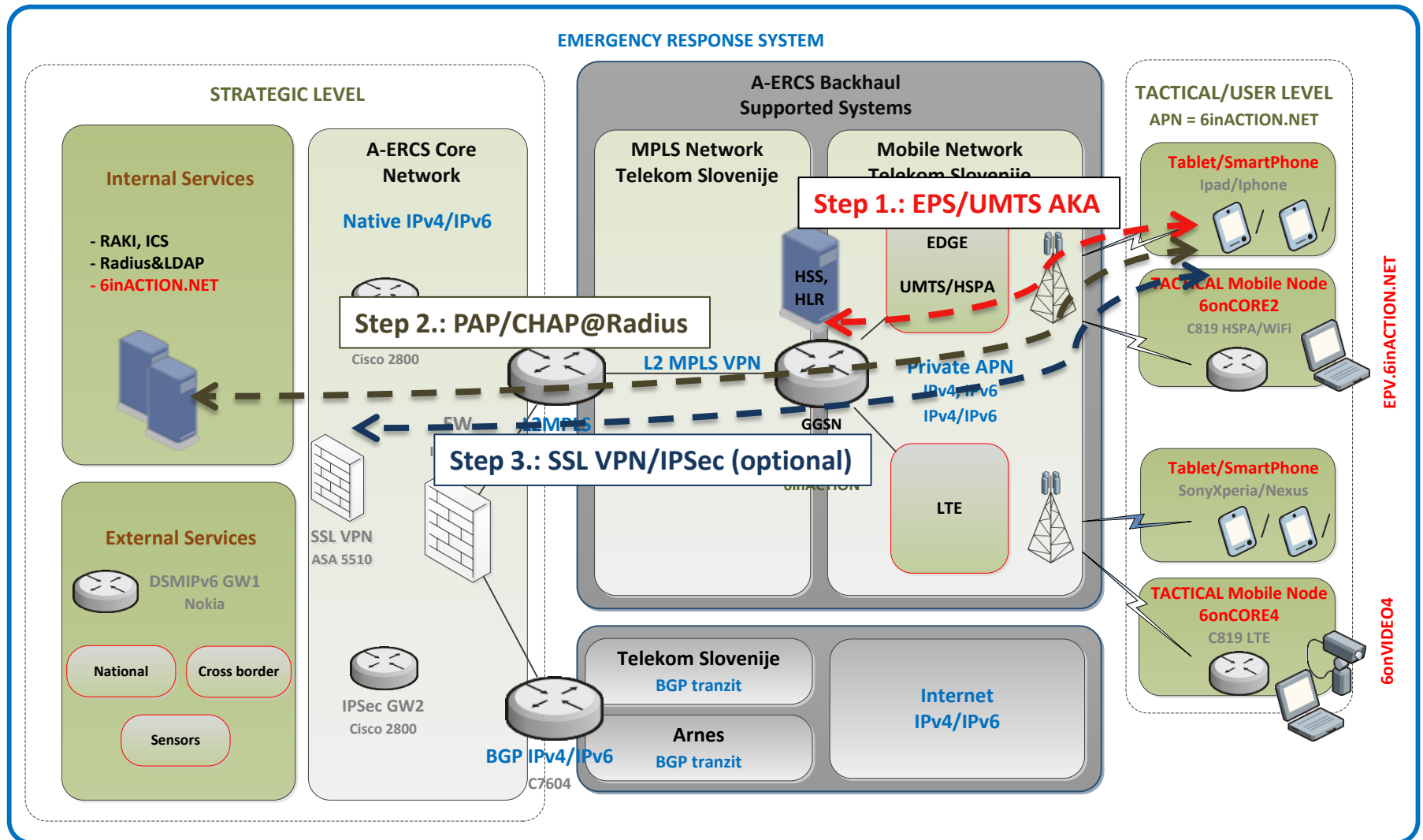
- Phase 1.: LTE/UMTS AKA – mobile provider
 - USIM Authentication and Key Agreement in HSS/HLR server
- Phase 2.: Extended node/user authentication and authorization – 6inACTION system
 - CHAP/PAP in Radius server
- Phase 3.: Additional encryption for the most critical services – 6inACTION system
 - IPSec for networking devices (6onCORE)
 - SSL VPN for end user devices (6onMOBILE)
 - DSMIPv6 for sensor gateway (6onFIRE)

- **Network parameter assignment**

- RADIUS assigned and P-GW/GGSN enforced IPv4&IPv6 parameters - 6inACTION system
- LTE option
 - IPv6 EPS bearer
 - IPv4 EPS bearer
 - IPv4/IPv6 EPS bearer
- HSPA/EDGE option
 - IPv6 PDP context
 - IPv4 PDP context
- SSL/TLS VPN option
 - IPv4/IPv6
 - IPv6
 - IPv4

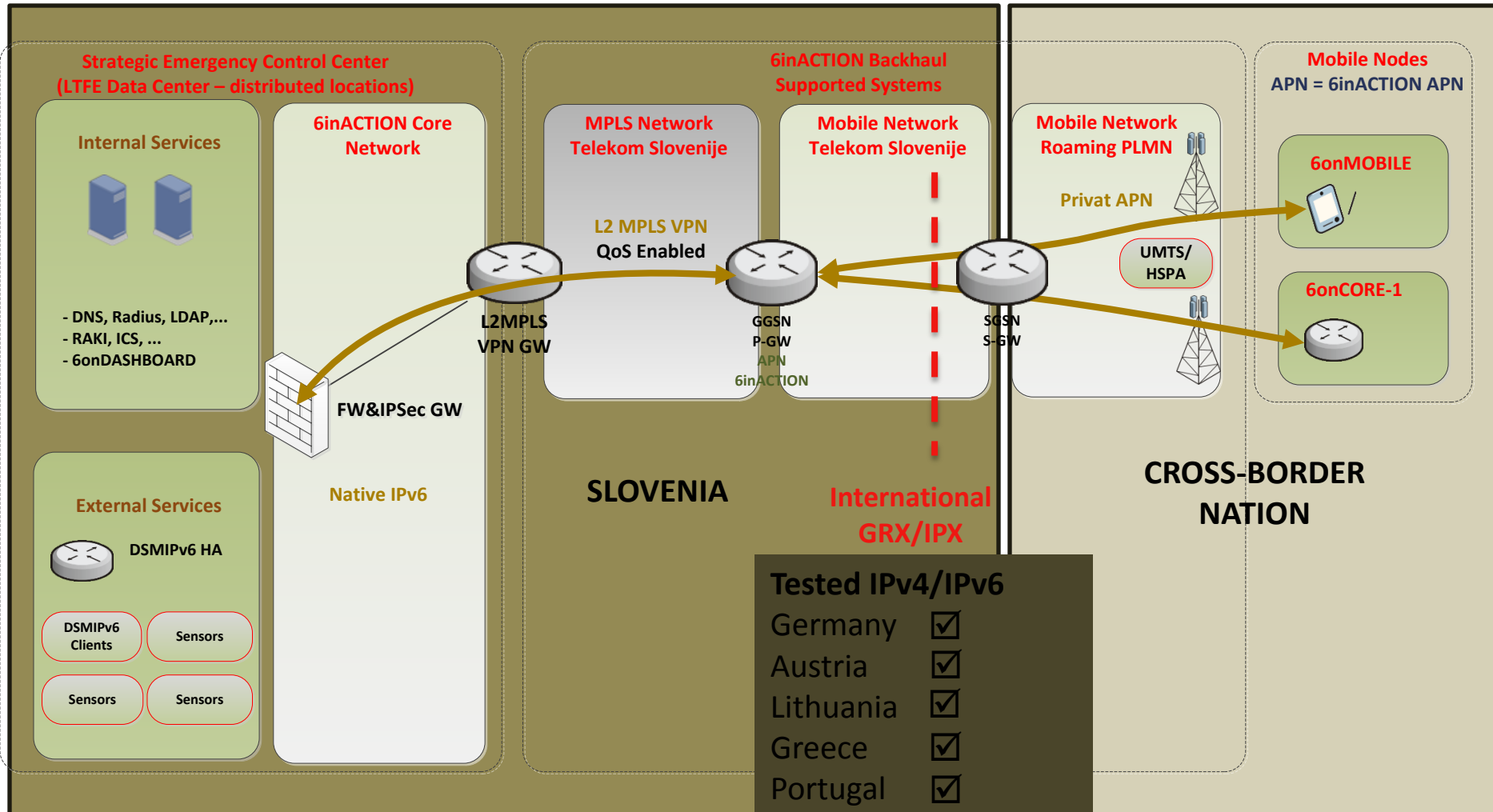
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6inACTION System – Detailed deployment architecture (mobile part)



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6inACTION – Architecture for Cross-border Operations over 3G/4G



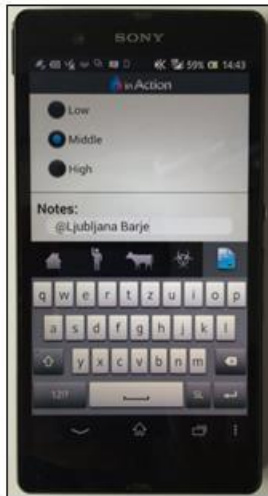
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Tactical Smart Devices

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TACTICAL & MISSION SMART DEVICES AND APPS

- COTS TERMINALS + IP67/MIL enclosure
 - Dust proof, water proof, drop/crash proof
- INTEGRATING CUSTOM TACTICAL AND IT APPS
 - Tracking, contextualized on-site triage, live video streaming
 - Mail, file share, video, picture, cloud apps
- IPv6 PDP Context / EPS bearer support?
 - Android:
 - iOS:



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IoT-Driven Intervention Management

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IoT-DRIVEN INTERVENTION MANAGEMENT

- Real-time common operational picture
 - Mash up of sensor and user events, live unit tracking, live video streaming and remotely captured on-site high resolution pictures

The screenshot displays the 6inACTION web interface. On the left, a window titled "LIVE VIDEO STREAMING" shows a road view. The main area is a map of Slovenia with a red dashed box highlighting a location near Ljubljana. A pop-up window for "Janez Sony" provides location and IP information. On the right, a "RT tracking" table lists various sensor and user events.

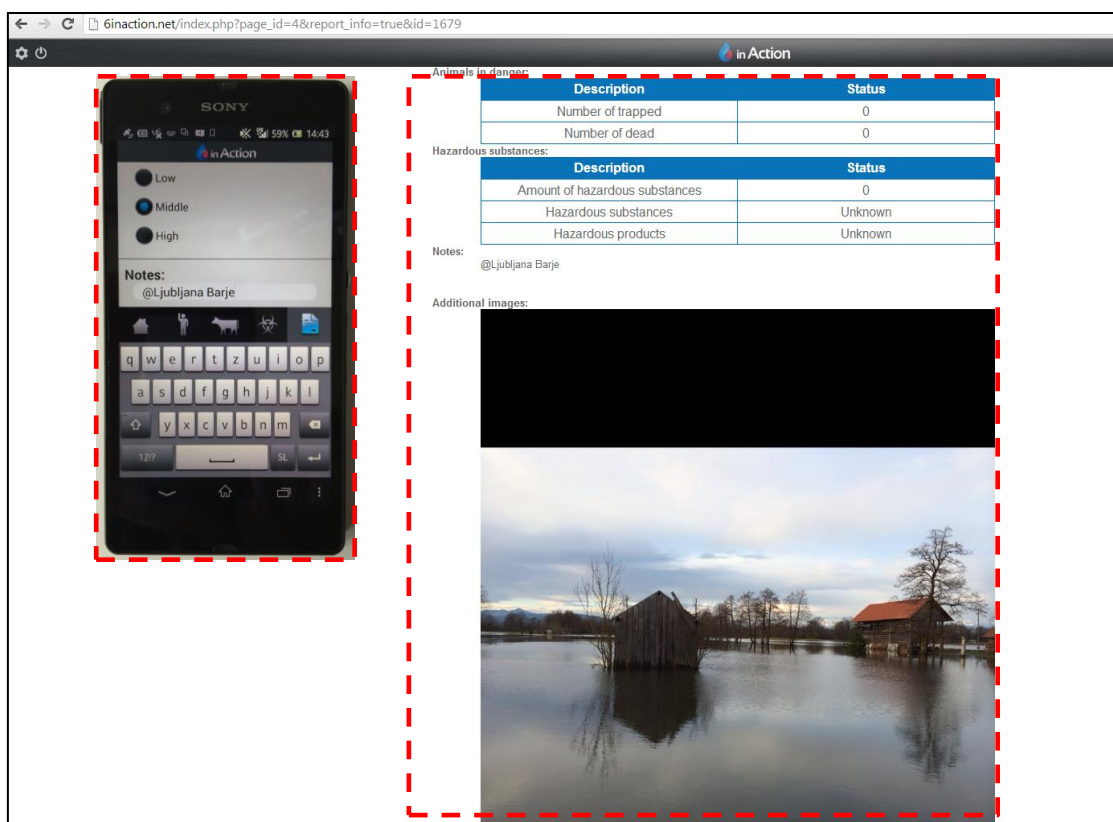
Time	Value	Event Name	Description
14:01:39 27/03/2014	1011.9r	Lukas Weather Station	Atmospheric Pressure
14:01:39 27/03/2014	61%	Lukas Weather Station	Outside Humidity
14:01:39 27/03/2014	11.1°C	Lukas Weather Station	Outside Temperature
14:09:56 27/03/2014	1	6onCORE	System UP
14:09:51 27/03/2014	1	6onCORE	System UP
14:09:35 27/03/2014	4.37m	Merilna Postaja Sava	Sava Vodostaj
14:09:34 27/03/2014	5.7	Merilna Postaja Sava	Sava Temp
14:08:56 27/03/2014	1	6onCORE	System UP
14:08:51 27/03/2014	1	6onCORE	System UP
14:08:33 27/03/2014	5.47	Merilna Postaja Sava	Sava Temp

RT-SENSOR AND USER EVENTS

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IoT-DRIVEN INTERVENTION MANAGEMENT

- Contextualized real-time triage reporting
 - User notes + site map + on-site captured high resolution picture + unit track



6inaction.net/index.php?page_id=4&report_info=true&id=1679

inAction

Animals in danger:

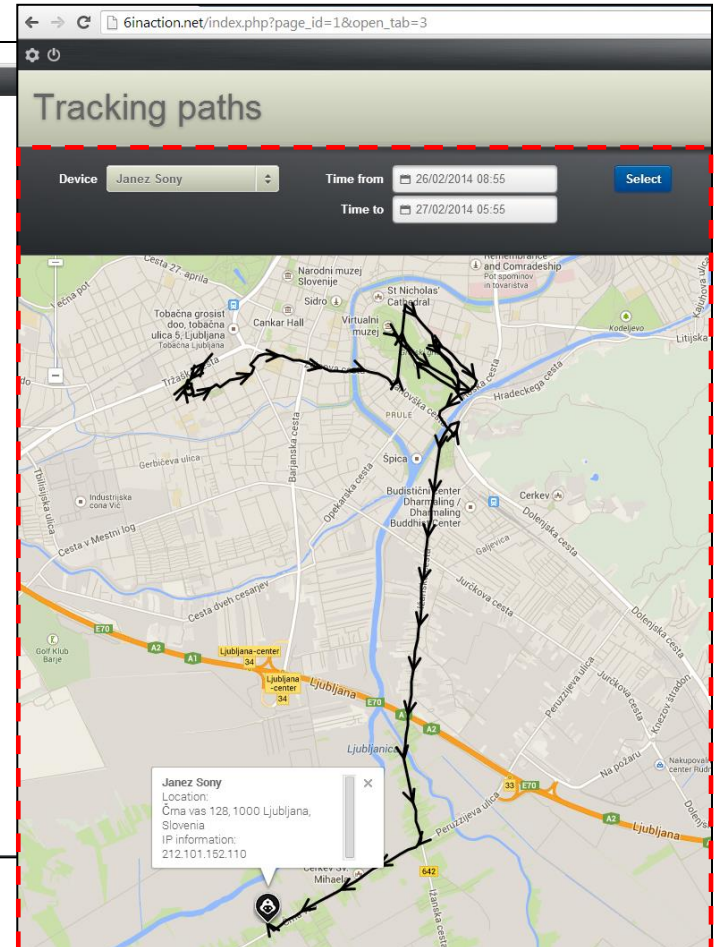
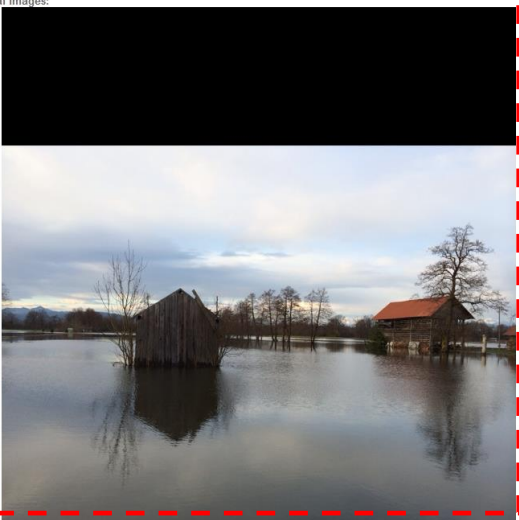
Description	Status
Number of trapped	0
Number of dead	0

Hazardous substances:

Description	Status
Amount of hazardous substances	0
Hazardous substances	Unknown
Hazardous products	Unknown

Notes:
@Ljubljana Barje

Additional images:



6inaction.net/index.php?page_id=1&open_tab=3

Tracking paths

Device: Janez Sony

Time from: 26/02/2014 08:55

Time to: 27/02/2014 05:55

Select

Location popup:
Janez Sony
Location:
Črna vas 128, 1000 Ljubljana,
Slovenia
IP information:
212.101.152.110

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Smart IoT Management

NATIONAL L./32 Municipalities

MOL (2a00:1368:ff03:02::/56)

256 Municipalities

LOGGED IN AS ADMIN@LTFE.ORG

Hi 

Administrator

- Devices 2 >
- Sensors 2 >
- Alarms 3 >
- Device Groups
- Users
- API Keys
- Documentation

Edit Device Group

Add groups

Group name:	EPV-SENSORS
Description:	Sensor LAN
Group network address:	2a00:1368:ff03:0202::
Prefix: /	64
Add devices to group:	<p>Select device <input type="button" value="Add to group"/></p> <p>MerilnaPostajaSava ✕</p> <p>6onFIRE ✕</p> <p>Lukas Weather Station ✕</p> <p>eHealth_test ✕</p>

EPV2 /56 (2a00:1368:ff03:02::/56)

LAN1 /64 (2a00:1368:ff03:0201/64)

256 Segments

Sensor LAN2 /64 (2a00:1368:ff03:0202/64)



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System piloting and testing



SPEEDTEST.NET 6/27/2011 8:45 AM GMT

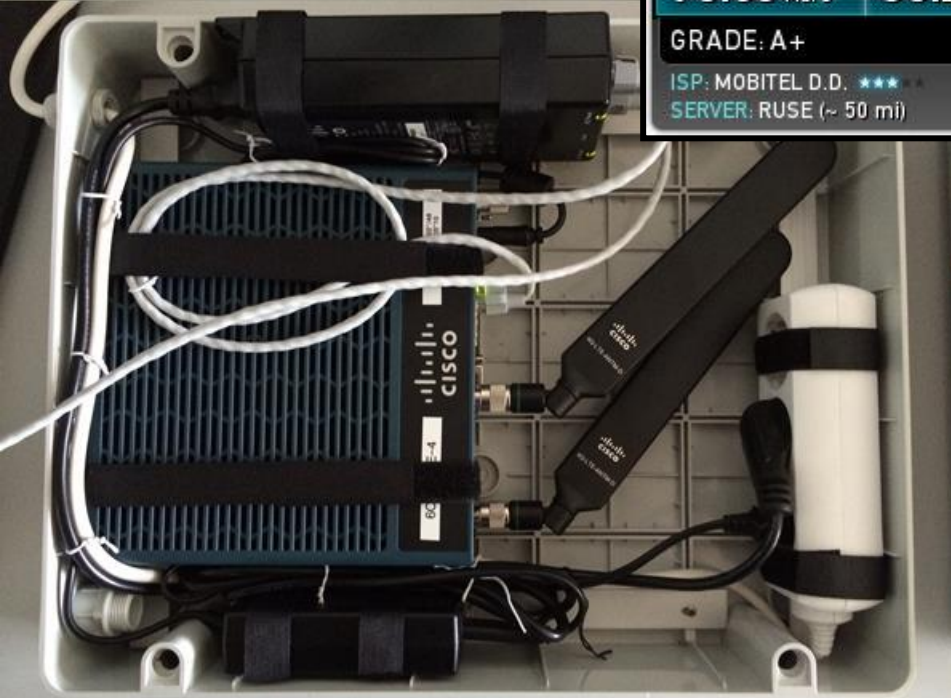
DOWNLOAD	UPLOAD	PING
95.63 Mb/s	35.24 Mb/s	35 ms

GRADE: A+ (FASTER THAN 99% OF S)

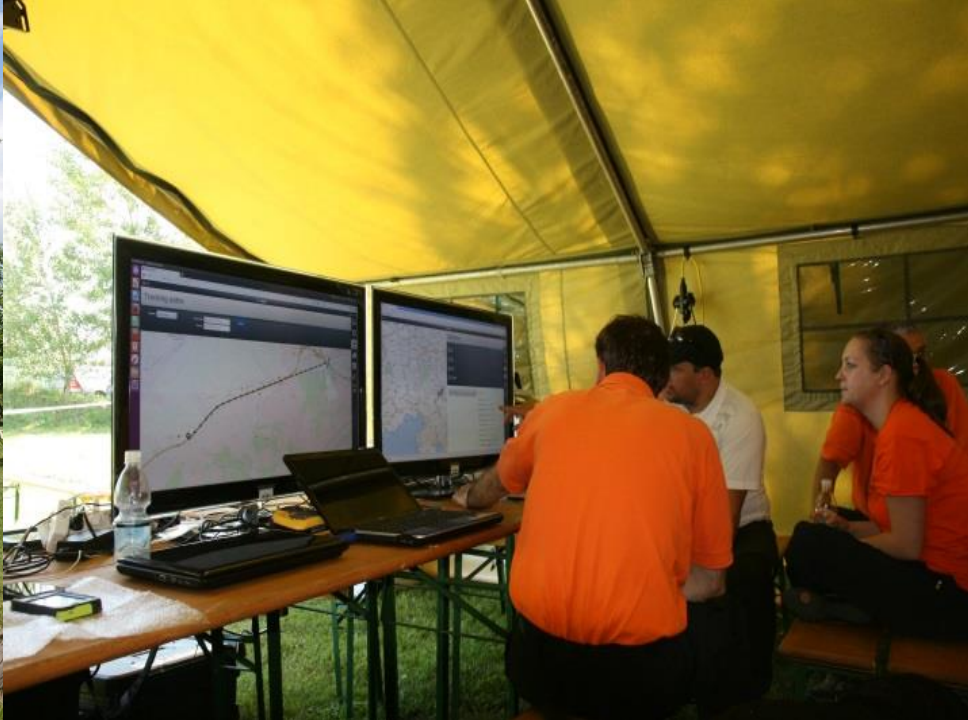
ISP: MOBITEL D.D. ★★★

SERVER: RUSE (~ 50 mi)

OOKLA







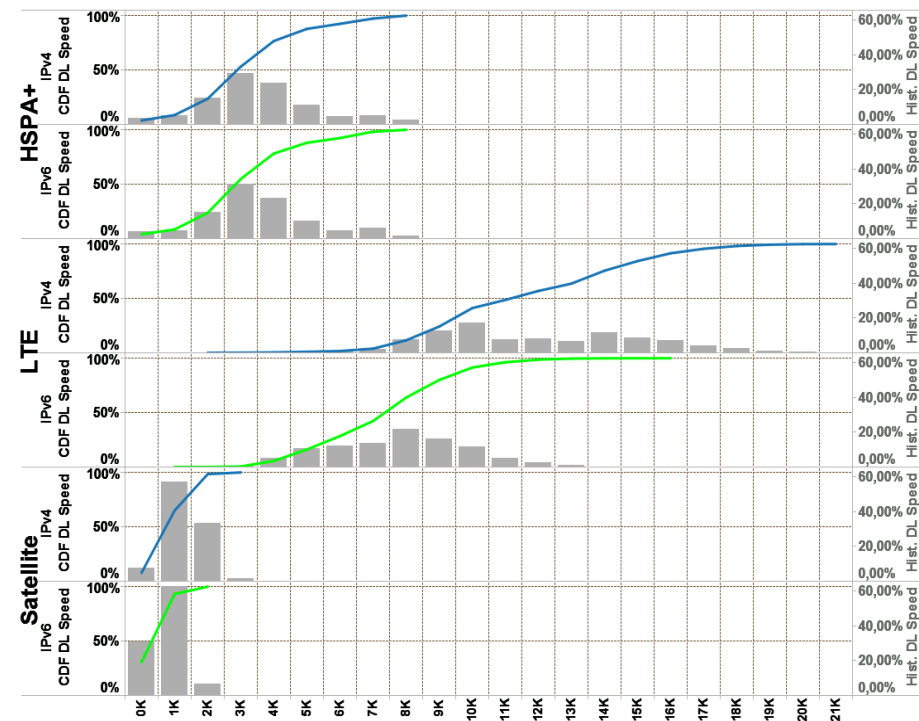
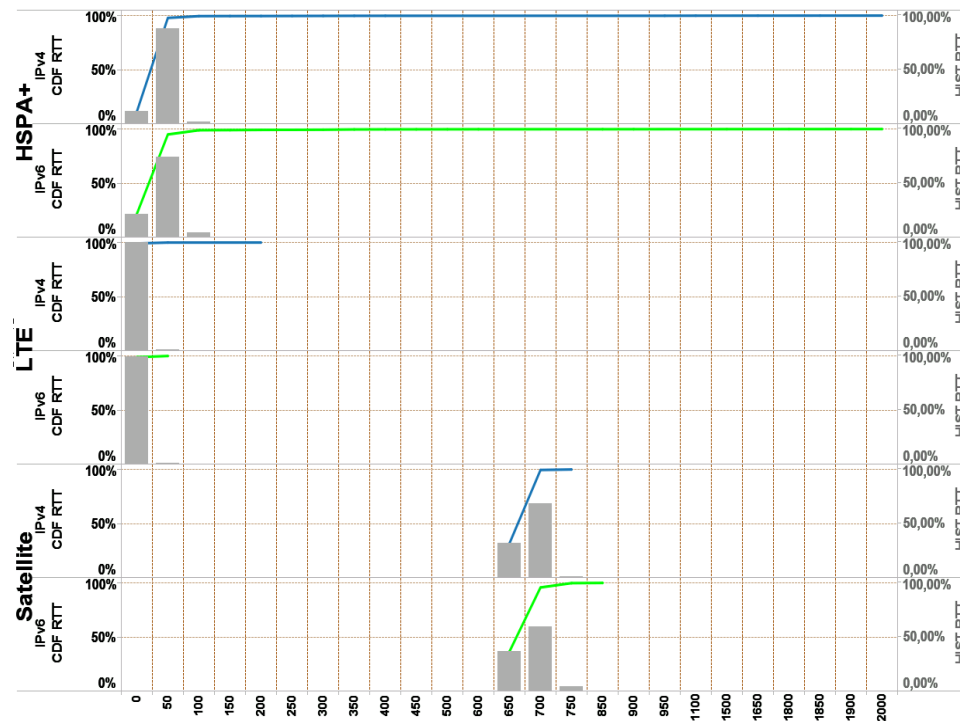
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System performance measurements (November 2013)

- results for densely populated city area – 5MHz BW (HSPA<E)

RTT delay [ms]

DL Speed [Kbit/s]

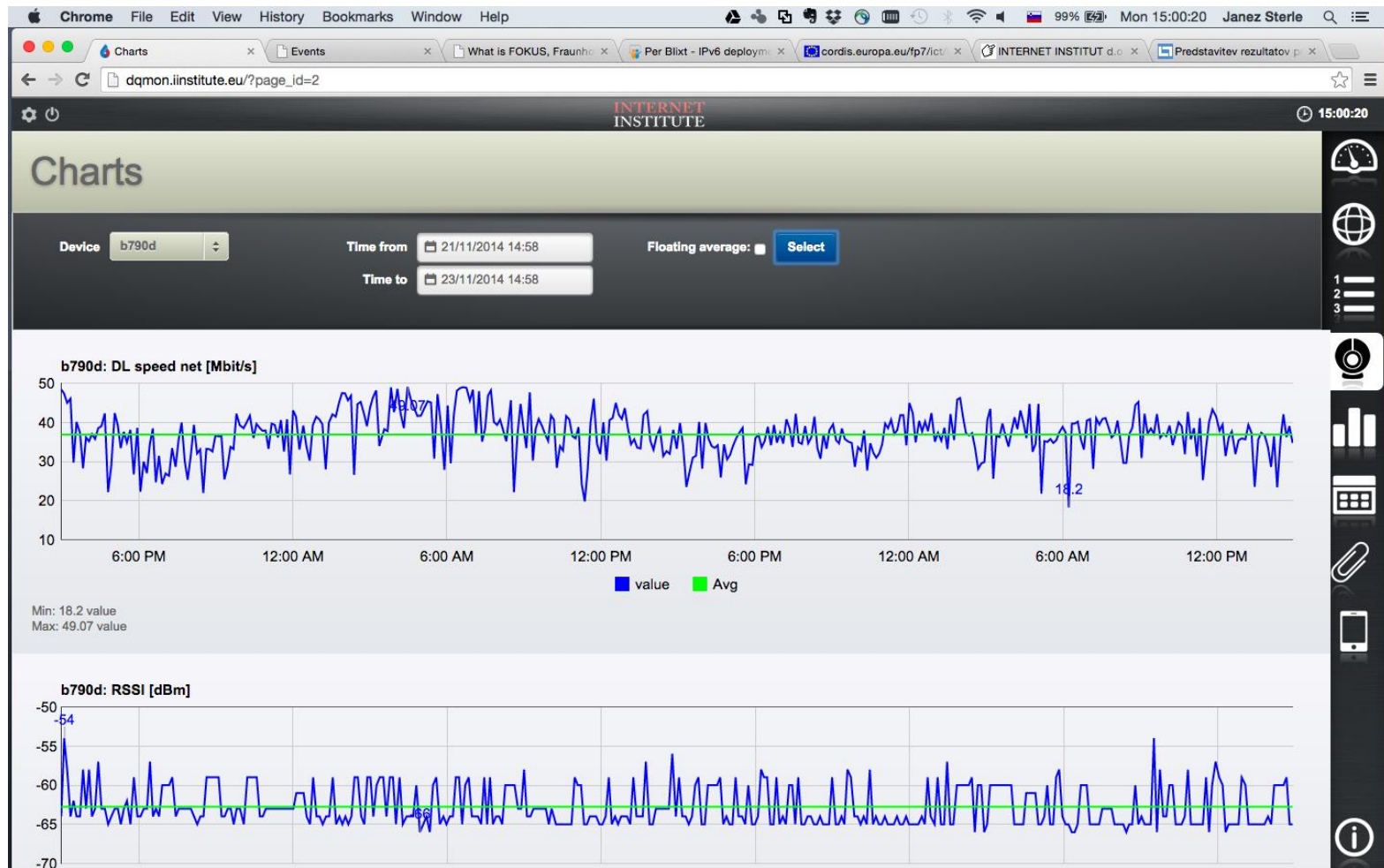


- CDF (line) and histogram (bar) graph
- Blue line (IPv4) and green line (IPv6)

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System performance measurements (November 2014)

- results for densely populated city area – 20MHz BW (LTE)



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Conclusion – IPv6<E for public safety?

- **Pros: “All IP” proven commercial technologies**
 - High mobile performance
 - up to 150 Mbps and 10 ms data plane (RTT delay using LTE)
 - **3G/4G bullet proof system integrated security**
 - AKA authentication, AES/3G SNOW user and control plane encryption
 - Extended authentication (i.e. RADIUS) for central user control and provisioning
 - For the most critical services, additional IPSec, SSL VPN and HTTPS security services
 - Standardized QoS support
 - Deployment options and system virtualization: business APNs, MVNO, national roaming
 - Standardized interfaces: various networking and handheld equipment vendors/providers
 - Open and powerful ecosystem for service (multimedia, sensors, M2M) development
 - Easy integration between custom services and existent IT services
 - Easy cross-border and international on-site cooperation
 - based on international roaming (GRX/IPX)
- **Cons: immature technologies in mission critical situations**
 - 3GPP public safety standardization not finished, missing “TETRA like” features
 - BB PPDR frequency band is in a process of EU allocation
 - Missing IPv6 support on “some” mobiles/tablets
 - Missing added value features on routing gear (i.e. NEMOv6 McA) ?
 - Millions invested in current professional systems (i.e. TETRA)

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Lead by ULFE, official GEN6 partner

Powered by partners

- Go6 Institute – federating and consultancy role,
- Ministry of Education, Science and Sport – integration of project in Slovenian government,
- Water Institute - Pilot system requirements and pilot testing,
- Municipality of Ljubljana (MOL), Department for Protection, Rescue and Civil Defense (OZRCO) – pilot system requirements and pilot testing, live emergency response environment & infrastructure,
- Telekom Slovenije, d. d. – fixed and mobile network provider
- Cisco System Slovenia&Global – networking equipment support.
- Academic and Research Network of Slovenia (ARNES)



Mestna občina Ljubljana



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arnes



University of Ljubljana
Faculty of Electrical Engineering



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